KUS-W36 Underwater Distance Sensor Manual

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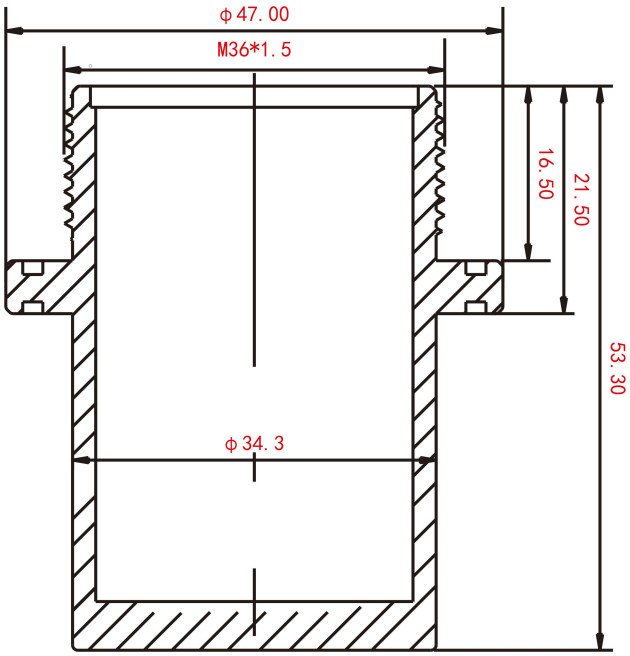
1.Introduction

The underwater distance measuring sensor uses ultrasonic waves to transmit in the water, and when it encounters the object to be measured, it reflects back and measures the distance between the sensor and the object to be measured, and transmits it to ships, buoys, underwater unmanned vehicles and other equipment. It can be used for obstacle avoidance and underwater distance measurement.
The product protection level reaches IP68 level, and it can be immersed in water for a long time within a depth of 10 meters without damage.

2.Measurement principle

The ultrasonic wave emitted by the ultrasonic probe propagates through water, encounters the target to be measured, and then returns to the ultrasonic probe through water after reflection. Because the time of emission and reception can be known, according to this time × sound speed ÷ 2 = the distance between the probe emission surface and the target to be measured.
Calculation formula: D = C*t/2
(Divided by 2 because the sound wave is actually a round trip from emission to reception, D is the distance, C is the sound speed, and t is the time).
If the time difference between emission and reception is 0.01 seconds, the sound speed in normal temperature fresh water is 1500 meters/second.
1500 meters/second×0.01 seconds=15 meters
15 meters÷2=7.50 meters
That is, the distance between the probe emission surface and the target to be measured is 7.50 meters.

3.Dimensions



4.Main technical indicators

4.1 Factory test standards:

Measured water quality: clean water, turbidity <500NTU;
Flowability: still water;
Water temperature: 20-30℃
Water depth: <1.00m
Measured target: flat swimming pool wall with a certain degree of roughness and an area of at least 1m x 1m.

4.2 Technical Parameters

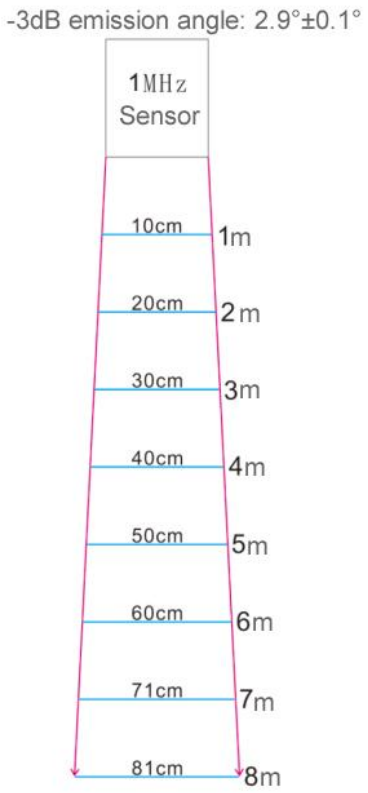
Measurement output result	Distance value between the probe emission surface and the measured target
Sensor connection method	M36×1.5 thread, with matching fixing nut
Appearance	cylindrical
Other sensor connection methods	thread or flange connection methods can be customized upon request
Blind area range	blind area varies according to different measurement ranges
Protection level	IP68
Power supply voltage range	DC 12.0V～30.0V
Power supply voltage and current	DC 24V, current <40mA; DC 12V, current <80mA
Equipment power consumption	DC 24V power supply: minimum power 24V×40mA=0.96W; DC 12V power supply: minimum power 12V×80mA=0.96W;
Output signal 1	1-way RS485 MODBUS protocol
Communication method 1	Response type, the host computer sends a command, and the sensor replies with the current measurement data once
Communication mode 2	Active upload, hexadecimal data, 5-10 times per second
Display	No display
Matching cable length	1 meter, up to 10 meters
Cable outlet	4 cores
Working water temperature	-10～+60℃
Working water depth	≤10 meters 11～100 meters, needs to be customized, size, material, circuit may change

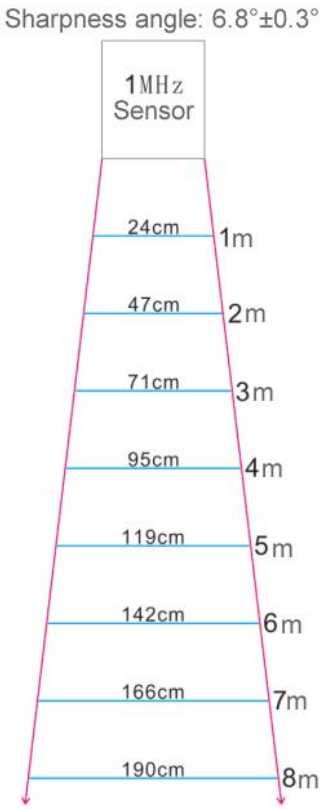
4.3 Relationship between measurement range and blind area:

Operating Frequency	Supply Voltage (Unit: V)	Maximum Measurement Range (Unit: m)	Blind Zone (Unit: m)	-3dB Emission Angle	Sharpness Angle
Standard product					
300KHZ	12V	7.50m	0.30m	10°	23°
300KHZ	24V	15.00m	0.40m	10°	23°
500KHZ	12V	5.00m	0.15m	5.8°	13.6°
500KHZ	24V	10.00m	0.20m	5.8°	13.6°
Customized product					
1MHZ	12V	2.00m	0.05m	2.9°	6.8°
1MHZ	24V	4.00m	0.07m	2.9°	6.8°

4.4 Emission angle

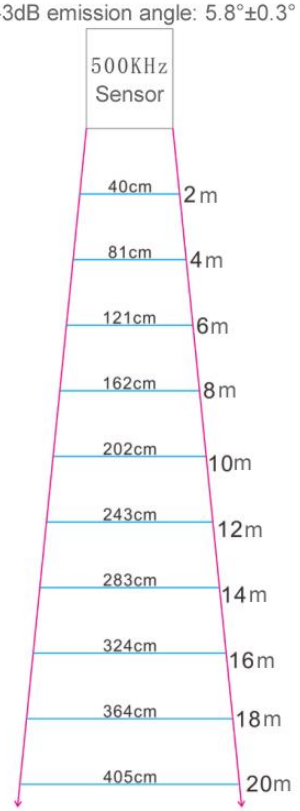
4.4.1 Emission angle at 1MHz operating frequency



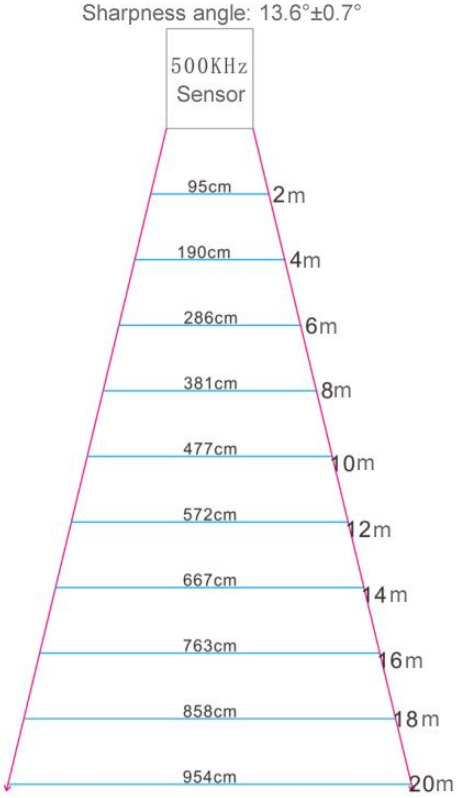


4.4.2 Emission angle at 500KHz operating frequency

-3dB emission angle: 5.8°±0.3°

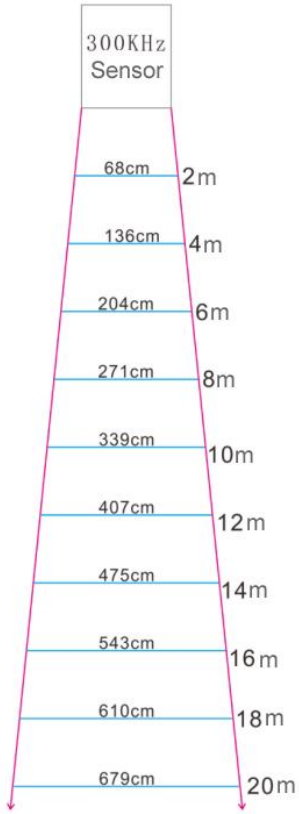


Sharpness angle: 13.6°±0.7°

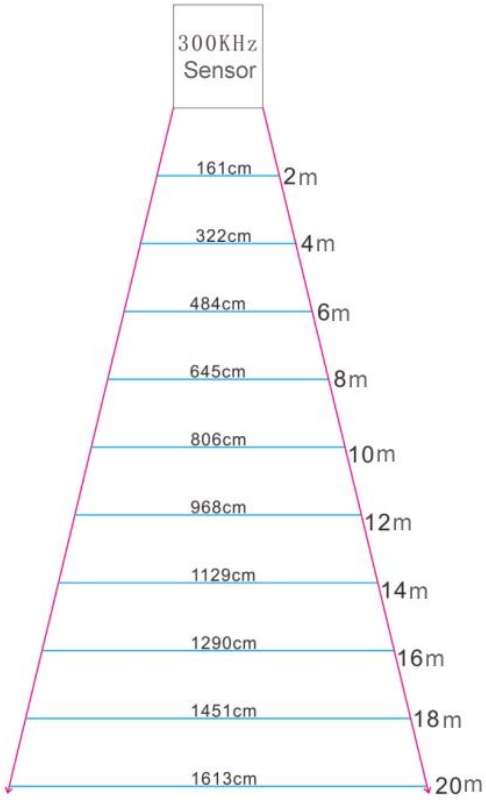


4.4.3 Emission angle at 300KHz operating frequency

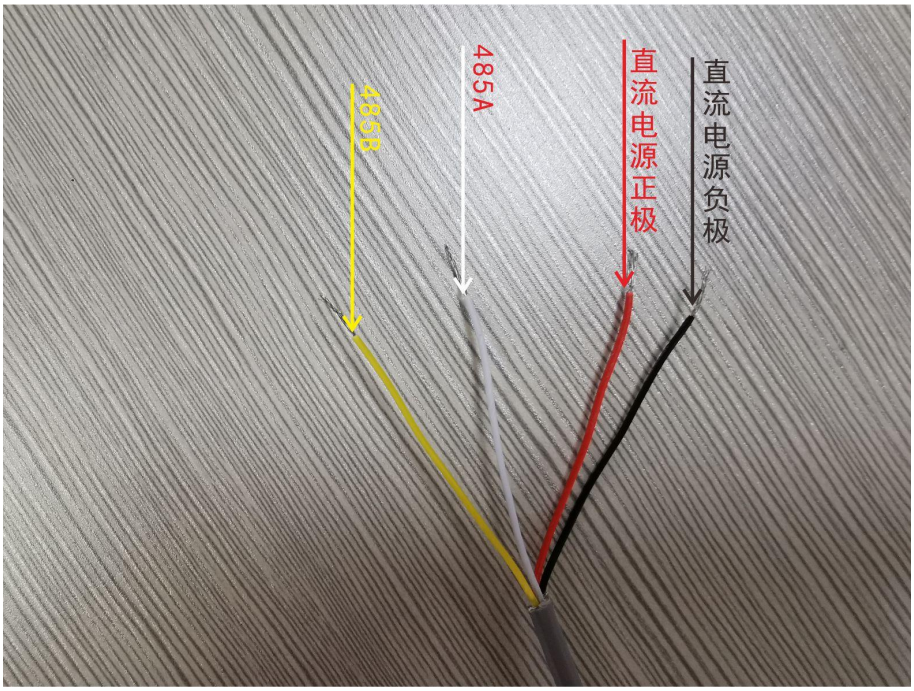
-3dB emission angle: 9.7°±0.5°



Sharpness angle: 22.8°±1.1°



4.5 Wiring



① 24V power supply RS485 wiring method
Power supply: red wire is DC 24VDC+, black wire is DC 24VDC–.
485 communication: white wire is 485A, yellow wire is 485B.

② RS232 output requires the black wire to be reliably grounded;
Grounding requirements: Please connect the black wire of the negative pole of the power supply to the ground.

4.6 Installation precautions

① Do not connect the power cord in reverse, otherwise the internal circuit will burn out;
② The power supply cannot be wrong. If it is wrong, the voltage higher than the maximum voltage that the instrument can withstand will burn out the internal circuit.
③ The RS232 output wiring cannot be connected in reverse, otherwise it will cause garbled or blank output.
④ The cable cannot be used to bear weight or force.
⑤ The cable outlet must be protected and cannot be flooded or immersed in water, otherwise the equipment will be damaged.
⑥ The cable must be protected to avoid wear, cuts, corrosion, etc., otherwise the equipment will be damaged.

5. MODBUS Communication Protocol

(1) The hardware uses RS-485, master-slave half-duplex communication, the master calls the slave address, and the slave responds to the communication.

(2) Data frame 10 bits, 1 start bit, 8 data bits, 1 stop bit, no check.
Baud rate: 4800 9600 19200 38400 115200 (default is 115200) (corresponding to 0, 1, 2, 3, 4). Note: 4800 corresponds to 0.

(3) Function code 03H: Read register value

Host sends:

1	2	3	4	5	6	7	8
ADR	03H	Starting register high byte	Starting register low byte	Register number high byte	Register number low byte	CRC code low byte	CRC code high byte

Byte 1 ADR: slave address code (=001~254)
Byte 2 03H: read register value function code
Bytes 3 and 4: start address of register to be read
Bytes 5 and 6: number of registers to be read
Bytes 7 and 8: CRC16 check from bytes 1 to 6

When the slave receives correctly, it sends back:

1	2	3	4、5	6、7		M-1、M	M+1	M+2
ADR	03H	Total bytes	Register data 1	Register data 2	……	Register data M	CRC code low byte	CRC code high byte

Byte 1 ADR: slave address code (=001~254)
Byte 2 03H: Return to read function code
Byte 3: Total number of bytes from 4 to M (including 4 and M)
Bytes 4 to M: Register data
Bytes M+1 and M+2: CRC16 check from byte 1 to M

When the slave receives an error, the slave sends back:

1	2	3	4	5
ADR	83H	Information code	CRC code low byte	CRC code high byte

Byte 1 ADR: slave address code (=001~254)
Byte 1 83H: error in reading register value
Byte 3 Information code: see information code table
Bytes 4 and 5: CRC16 checksum from bytes 1 to 3

(4) Function code 06H: Write a single register value

Host sends:

1	2	3	4	5	6	7	8
ADR	06H	Register address high byte	Register address low byte	Data high byte	Data low byte	CRC code low byte	CRC code high byte

When the slave receives correctly, it sends back:

1	2	3	4	5	6	7	8
ADR	06H	Register address high byte	Register address low byte	Data high byte	Data low byte	CRC code low byte	CRC code high byte

When the slave receives an error, the slave sends back:

1	2	3	4	5
ADR	86H	Error code	CRC code low byte	CRC code high byte

Byte 1 ADR: Slave address code (=001~254)
Byte 1 86H: Write register value error function code
Byte 3 Information code: See information code table
Bytes 4 and 5: CRC16 check from bytes 1 to 3

(5) Function code 10H: Write multiple register values continuously

Host sends:

1	**2**	**3**	**4**	**5**	**6**	**7**
ADR	10H	Starting register high byte	Starting register low byte	Register number high byte	Register number low byte	Total bytes
8、9		**10、11**	**N、N+1**	**N+2**	**N+3**	
Register data 1		Register data 2	Register data M	CRC code low byte	CRC code high byte	

When the slave receives correctly, it sends back:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
ADR	10H	Starting register high byte	Starting register low byte	Register number high byte	Register number low byte	CRC code low byte	CRC code high byte

When the slave receives an error, the slave sends back:

1	**2**	**3**	**4**	**5**
ADR	90H	Error code	CRC code low byte	CRC code high byte

Byte 1 ADR: Slave address code (=001~254)
Byte 1 90H: Write register value error function code
Byte 3 Information code: See information code table
Bytes 4 and 5: CRC16 check from bytes 1 to 3

Register Definition Table									
Register address	Description			Read only	Register address	Description			Read only
0000	0	1	Distance	√	0001	2	3	Reserved	√
0002	4	5	Temperature	√	0003	6	7	Reserved	√
005E	188	189			005F	190	191		
0060	192	193			0061	194	195	Factory reset System reset	
0062	196	197	Baud rate setting METERW ORK		0063	198	199	Test cycle Number of pulses	
0064	200	201			0065	202	203		
0066	204	205			0067	206	207		
0068	208	209			0069	210	211		
006A	212	213			006B	214	215	Meter type √ Instrument address	
006C	216	217			006D				

6. Information code table

Information Code	Meaning
01H	Illegal function code
02H	Illegal data address
03H	Illegal data value
04H	CRC16 check error
05H	Received correctly
06H	Received incorrectly
07H	Parameter error

When the CRC check error occurs, send

1	2	3	4	5
ADR	Received function code	04H	CRC code low byte	CRC code high byte

When the function code is wrong, send:

1	2	3	4	5
ADR	Received function code	01H	CRC code low byte	CRC code high byte

When the received address is different from the device address, no response is made.